77 Ups and Downs

INVESTIGATION

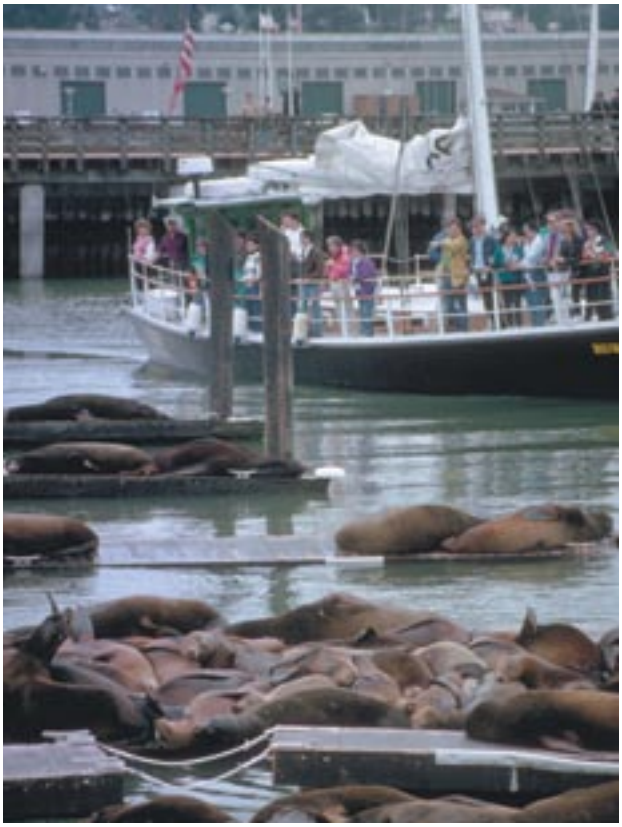
You can gather ecological information by studying an individual organism, as you did in Activity 74, "Observing Organisms." But most organisms do not affect an environment as individuals, but as groups. Groups of individuals of a single species that live in the same place are known as populations. The photos on this page and the next show different populations of sea lions.

One introduced species that is causing a lot of problems in the United States is the zebra mussel. Its success in freshwater environments has caused the loss of native wildlife as well as damage to equipment. How fast is this population spreading? Some investigators predict that populations of zebra mussels will be found across the entire United States within 20 years. Studying what has happened to populations of zebra mussels in lakes around the world can help scientists figure out what changes are occurring in the U.S. and what to expect for the future.

CHALLENGE

How do scientists study the size of a population and predict future population changes?

The photo below shows a population of sea lions living on a beach. The photo at right shows a population of sea lions living on piers in a harbor.



MATERIALS

For each pair of students

1 **Student Sheet 77.1, "Ups and Downs"**

For each student

1 **Student Sheet 77.2, "Anticipation Guide: Introduced Species—Zebra Mussels"**

PROCEDURE

Complete the "Before" column of Student Sheet 77.2, "Anticipation Guide: Introduced Species—Zebra Mussels."

Part A: Initial Observations

1. In your group of four, review the two tables below. Imagine that two different groups of ecologists collected data on the size of the zebra mussel population in Lake Miko for two different time periods.

Table 1: Zebra Mussel Population in Lake Miko, Period 1 (1959 to 1968)

Year	1959	1960	1962	1968
Number of Zebra Mussels (per square meter)	2,211	95	93	97

Table 2: Zebra Mussel Population in Lake Miko, Period 2 (1971 to 1976)

Year	1971	1972	1974	1976
Number of Zebra Mussels (per square meter)	393	802	1,086	2,179

2. Divide your group in half. Assign one of the two data tables to each pair within your group.

3. With your partner, create a line graph of the data in your table using Student Sheet 77.1, "Ups and Downs." Remember, independent variables, such as time, are always graphed on the x-axis. Since you will compare graphs within your group, make sure that the x-axes of both graphs use the same scale.

4. After completing your graph, respond to the two questions on Student Sheet 77.1 as directed.

Part B: A More Complete Analysis

5. Show your graph to the other students in your group. Point out the overall population trend—is the population increasing, decreasing, or staying the same?

6. Compare the two graphs. Discuss what conclusions you can make about the population trend in Lake Miko during Period 1 vs. Period 2.

7. Place the two graphs together, with the graph for Table 1 first and the graph for Table 2 second. If necessary, fold the edges of your sheets to fit the graphs together.

8. As a group, discuss what happens to the population trends when the two graphs are connected. Discuss how what you see with the two graphs together is different from what you see with each of the individual graphs. Be sure to:
   - Describe what happens to the population size of zebra mussels in Lake Miko from 1959–1976.
   - Discuss whether you can make any definite conclusions about whether the population is increasing, decreasing, or staying the same.

ANALYSIS

1. **a.** Sketch a line on your graph predicting what you think will happen to the size of this population of zebra mussels during the ten years after 1976.

   b. Explain your prediction. Why do you think the graph will look that way?

   c. What additional information would make you more confident of your prediction? Explain.

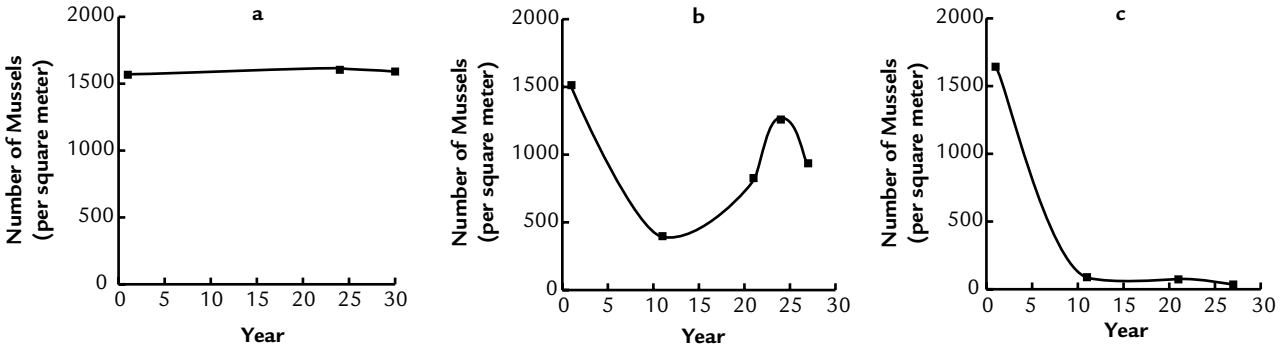
2. **a.** What factors do you think affect the size of a population?

   b. Explain how each factor might affect population size: Would it cause the population to increase, decrease, or stay the same? Why?

3. As you know from your own graph, data were not collected every year. Explain whether you would expect a well-designed experiment to collect data every year. What might prevent the collection of such data?

4. Shown below are graphs of zebra mussel populations in three lakes near Lake Mikolajskie. Describe the population trend in each graph. How does each population change over time?

ZEBRA MUSSEL POPULATIONS IN THREE LAKES



5. The data presented in this activity are similar to actual data collected in Lake Mikolajskie, Poland, between 1959 and 1987. Zebra mussels have been found in lakes in that area for over 150 years. Shown below are the data collected from 1977–87. How does this additional information compare to your answer to Question 1?

Table 3: Zebra Mussel Population in Lake Miko, Period 3 (1977 to 1987)

Year	1977	1979	1982	1983	1987
Number of Zebra Mussels (per square meter)	77	104	81	55	85

6. Zebra mussels were introduced in the United States in the late 1980s. They first appeared in Lake Erie, one of the Great Lakes. Today, the population of zebra mussels has reached as high as 70,000 mussels per square meter in some parts of Lake Erie.

   a. How does this compare to the populations of zebra mussels found in the lakes in Poland?

   b. Before 1988, the population of zebra mussels in Lake Erie was zero. Draw a graph showing what you think the data might look like for the population of zebra mussels in Lake Erie from 1985 to the present.

7. Consider the zebra mussel population in Lake Mikolajskie from 1959 to 1987. Describe what you think happened to the zebra mussel population from 1987 to 1997. Explain your reasons for your prediction.

8. Fill in the "After" column for Statements 1 and 2 only on Sheet 77.2, "Anticipation Guide: Introduced Species—Zebra Mussels." Did your thinking change?